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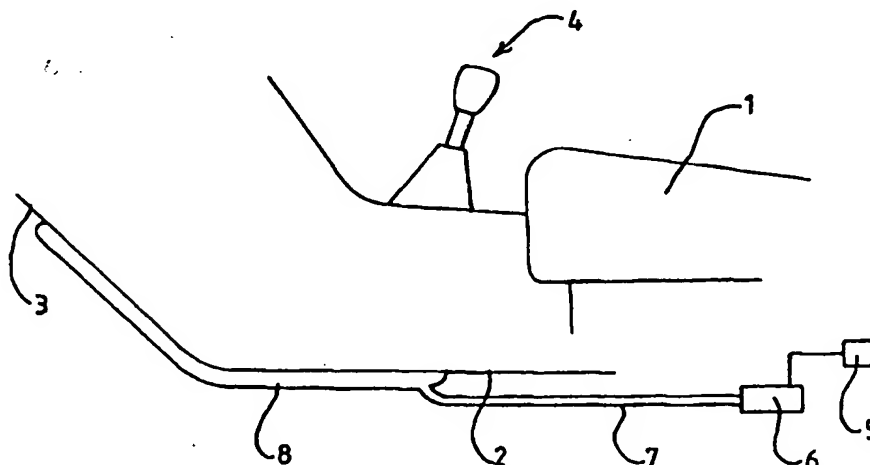
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(21) International Application Number: PCT/SE97/01317 (22) International Filing Date: 30 July 1997 (30.07.97) (30) Priority Data: 9616229.2 1 August 1996 (01.08.96) GB (71) Applicant (for all designated States except US): AUTOLIV DEVELOPMENT AB [SE/SE]; S-447 83 Vårgårda (SE). (72) Inventor; and (75) Inventor/Applicant (for US only): HÅLAND, Yngve [SE/SE]; Fågelsträcket 24, S-239 40 Falsterbo (SE). (74) Agent: MEULLER, Erik; Autoliv Development AB, S-447 83 Vårgårda (SE).		(81) Designated States: BR, DE, JP, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report.

(54) Title: A SAFETY ARRANGEMENT



(57) Abstract

A safety arrangement in a motor vehicle includes a support (8) located on the floor (2) of a motor vehicle in front of the front seat (1). The support (8) has an upper surface which is raised to an elevated position to provide yieldable support for the feet of the occupant of the vehicle if an accident occurs. The support (8) may comprise an air-bag associated with a gas generator (6) and a crash sensor (5). When an accident occurs, the feet of the occupant of the vehicle are raised to an elevated position.

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"A SAFETY ARRANGEMENT"

THE PRESENT INVENTION relates to a safety arrangement, and more particularly relates to a safety arrangement in a motor vehicle, such as a motor car.

When a motor vehicle is involved in a frontal impact, there is a risk that an occupant of the front seat of the motor vehicle may suffer injury to the feet, legs or knees.

For example, injuries can occur in the foot or ankle due to a short, rapid acceleration of the floor in the foot well. In a typical accident situation, the floor may accelerate upwardly and inwardly with an instantaneous acceleration which may be as high as 1,000g. Since the feet and legs of an occupant of a motor vehicle may well be resting on the floor, and will have inertia, it is to be appreciated that this high acceleration of the floor may cause substantial injuries to the feet and/or lower legs of the occupants of the vehicle. Similar injuries may also arise if the floor of the foot well is penetrated by, for example, part of the suspension of the vehicle, or some other component which is driven rearwardly into the foot well as a consequence of the accident. Sometimes fractures of the lower leg are experienced as a consequence of the leg being trapped under the fascia, and the situation may be made worse if the floor or fascia is penetrated by components driven rearwardly during the accident.

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Further injuries can be caused to the knees of the occupant and, additionally, injuries can be caused by the feet or legs of the occupant impacting with the pedals present in the motor vehicle.

Various proposals have been made previously in attempts to overcome these problems. For example, DE-A-4,335,511 discloses a complex arrangement in which the pedals are retracted to a position in which they are unlikely to injure the occupant of the vehicle in the event that an accident should arise. Various types of padding have also been proposed to provide protection for the knees of an occupant of a vehicle, the padding comprising an air-bag, a resilient element or even a resilient element mounted on a movable support. Reference may be made to DE-A-2,109,637, DE-A-4,243,791 and DE-A-4,301,933.

The prior proposed arrangements are relatively complex, and the present invention seeks to provide an improved safety arrangement for use in a motor vehicle.

According to this invention there is provided a safety arrangement in a motor vehicle, the arrangement comprising support means initially located on the floor in front of a front seat of the vehicle, which means present an upper surface, accident responsive means being provided which respond to an accident situation to cause the upper surface of said support means to move to an elevated position.

Preferably the upper surface, when in the elevated position, provides a yieldable support for the feet of an occupant of the vehicle.

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Conveniently the said support means comprise an air-bag initially located on the floor of the vehicle in front of the seat, said accident responsive means comprising means to inflate the air-bag and sensor to sense an accident to activate the means which inflate the air-bag.

In an alternative embodiment of the invention the support means comprise at least one flexible element extending initially along a non-linear path extending across the floor of the vehicle, said accident responsive means comprising means to apply tension to the flexible element to cause the flexible element to follow a substantially linear path, thus elevating the upper surface of the or each flexible element.

Conveniently the said at least one flexible element comprises two flexible straps.

Advantageously the means adapted to apply tension to the or each flexible element comprise a piston-and-cylinder device, means to supply gas to the piston-and-cylinder device to move the piston and sensor means adapted to activate the means to supply gas in response to an accident being sensed.

In a preferred embodiment means are provided to retain part of the or each flexible element in a predetermined position adjacent a junction between two non-aligned portions of the floor of the vehicle.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of

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example, with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic cross-sectional view of one safety arrangement in accordance with the invention in an initial state,

FIGURE 2 is a view corresponding to Figure 1 showing the safety arrangement of Figure 1 in an operative state,

FIGURE 3 is a view illustrating the operative parts of a safety arrangement comprising a second embodiment of the invention in a preliminary state, and

FIGURE 4 is a corresponding view illustrating the safety arrangement of Figure 3 in the operative state.

Throughout the drawings, like references relate to like parts.

Referring initially to Figures 1 and 2 of the accompanying drawings, a safety arrangement is illustrated which is mounted in position in a motor vehicle. The front seat 1 of the motor vehicle is visible, as is floor 2 in the front of the front seat and an inclined scuttle 3 which is located further forwardly within the motor vehicle. The floor 2 and the scuttle 3 together form a foot well. The gear stick 4 is also illustrated.

A crash sensor 5 is provided adapted to sense a frontal impact or a severe deceleration of the motor vehicle. The sensor 5 is adapted to control a gas generator 6 which generates gas. The gas generator 6 may

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comprise a pyrotechnic device or may comprise a source of compressed gas.

A duct 7 leads from the gas generator to an air-bag 8 which, as shown in Figure 1, has an initial uninflated position in which the upper surface of the air-bag is flush with the floor 2 located in front of the seat 1 and with the sloping scuttle 3. The scuttle 3 slopes, whereas the floor 2 is horizontal. The scuttle 3 is thus not aligned with the floor 2.

It is to be appreciated that the arrangement shown in Figure 1 will be totally unobtrusive when in the condition illustrated. A carpet may be located resting on the floor above the air-bag 8 and resting on the scuttle 3.

In the event that an accident should be sensed by the sensor 5, the gas generator 6 will be activated and gas will flow through the conduit 7 to inflate the air-bag 8. The air-bag will then have the condition illustrated in Figure 2.

It is to be appreciated that the upper surface of the air-bag will have been elevated as a consequence of the inflation of the air-bag.

If a person is occupying the seat 1 when the air-bag is inflated, the feet of the person occupying the seat will be elevated as the air-bag 8 inflates. The air-bag will form a relatively soft yieldable cushion located beneath the feet of the occupant of the vehicle.

It is to be appreciated that with the feet of the occupant elevated, even if the floor of the motor vehicle is given a very high acceleration, because the feet of the

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occupant are not in contact with the floor, no severe injury will be imparted immediately to the feet or legs of the occupant of the vehicle. The air-bag will act as a "cushion" between the floor and the feet of the occupant, and even if the feet of the occupant remain in their elevated position as the floor accelerates inwardly, because there is no contact between the floor and the feet of the occupant, no injury will be inflicted on the feet of the occupant by the floor. Also, of course, there is a minimal risk of any item penetrating the foot well and injuring the feet of the occupant of the vehicle. Also, since the knees of the occupant will also be elevated, the risk of injury occurring to the knees of the occupant of the vehicle is also reduced. Furthermore, since the upper surface of the air-bag will have elevated the feet of the occupant of the seat above the pedals of the vehicle (assuming that the occupant of the seat is the driver of the vehicle), there is no need to provide any complicated mechanism to move the pedals to a retracted position.

Figures 3 and 4 illustrate an alternative embodiment of the invention. Again the front seat 1, floor 2 and scuttle 3 are illustrated, together with the gear stick 4.

The crash sensor 5 is again associated with a gas generator 6. The gas generator 6, however, supplies gas through a conduit 7 to a piston and cylinder device 9. A shaft 10, which is connected to the piston, extends from the piston-and-cylinder device 9 and engages a transverse bar 11. Each end of the transverse bar 11 is connected to a flexible element comprising length of strap 12,13. Instead of two straps, a single sheet of flexible material could be utilised. Each length of strap 12,13 extends across the floor 2 to a position adjacent the junction

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between the floor 2 and the scuttle 3. A retaining bar 14 extends across the straps and is retained in position by releasable connecting elements 15. Terminal portions of the straps 12,13 extend up the scuttle 3 to a terminal retaining bar 16 which secures the ends of the straps 12,13 to the scuttle 3. Thus, each strap initially extends along a non-linear path extending across the floor of the vehicle in front of the seat.

In the event that an accident should arise, the sensor 5 will activate the gas generator 6, causing the piston to be drawn into the cylinder of the piston-and-cylinder device 9. This draws the transverse bar 11 rearwardly, applying tension to the straps 12,13. The straps 12,13 tend to rise, and the retaining bar 14 becomes disengaged from the releasable connectors 15. The straps thus become tensioned, as illustrated in Figure 4. The straps then follow a substantially linear path.

The upper surface of the straps thus become elevated above the floor 2 and scuttle 3, causing any carpet present on top of the straps also to rise. The arrangement again effectively provides a yieldable support for the feet of the occupant of the vehicle, with the feet of the occupant of the vehicle being raised to an elevated position.

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CLAIMS:

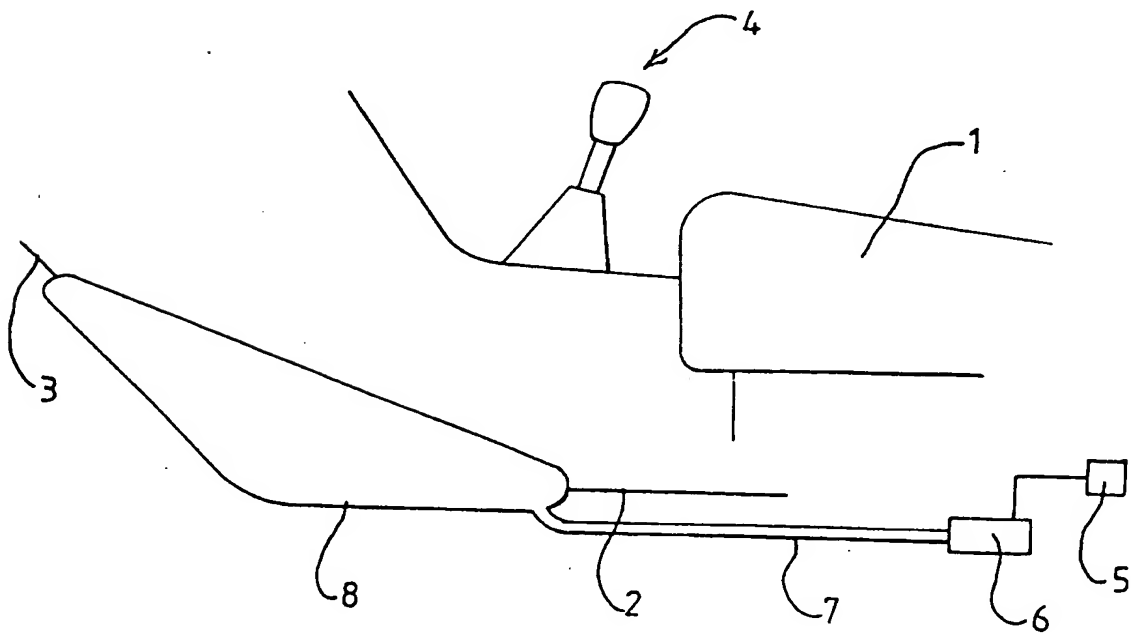
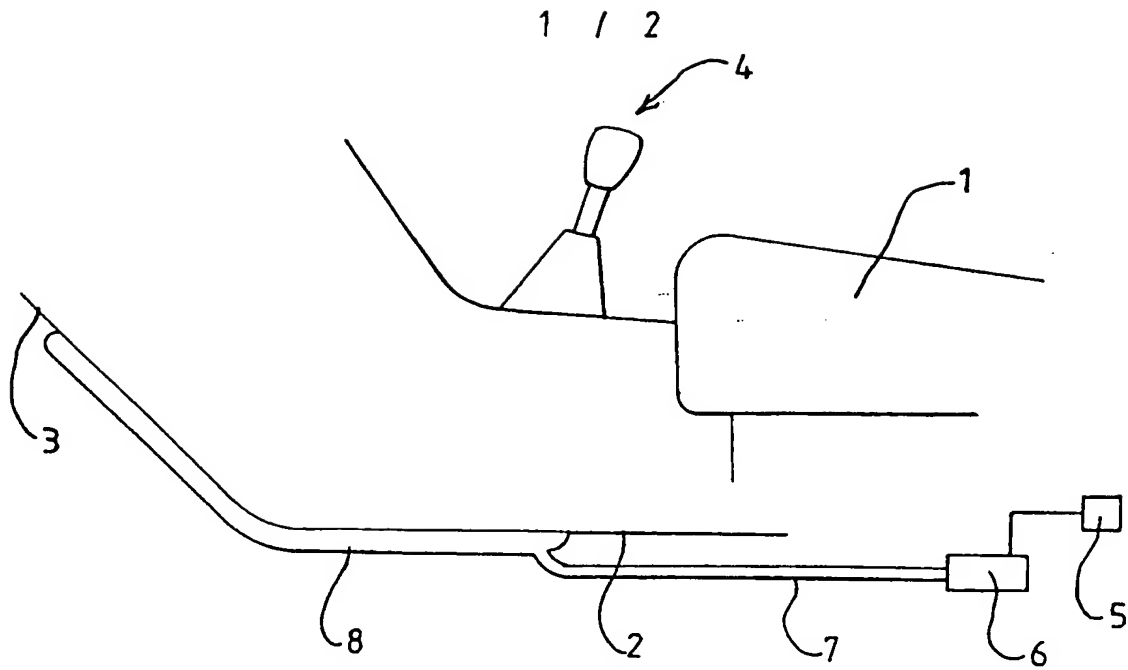
1. A safety arrangement in a motor vehicle, the arrangement comprising support means initially located on the floor in front of a front seat of the vehicle, which means present an upper surface, accident responsive means being provided which respond to an accident situation to cause the upper surface of said support means to move to an elevated position.
2. A safety arrangement according to Claim 1 wherein the upper surface, when in the elevated position, provides a yieldable support for the feet of an occupant of the vehicle.
3. A safety arrangement according to Claim 1 or 2 wherein the said support means comprise an air-bag initially located on the floor of the vehicle in front of the seat, said accident responsive means comprising means to inflate the air-bag and sensor to sense an accident to activate the means which inflate the air-bag.
4. An arrangement according to Claim 1 or 2 wherein the support means comprise at least one flexible element extending initially along a non-linear path extending across the floor of the vehicle, said accident responsive means comprising means to apply tension to the flexible element to cause the flexible element to follow a substantially linear path, thus elevating the upper surface of the or each flexible element.

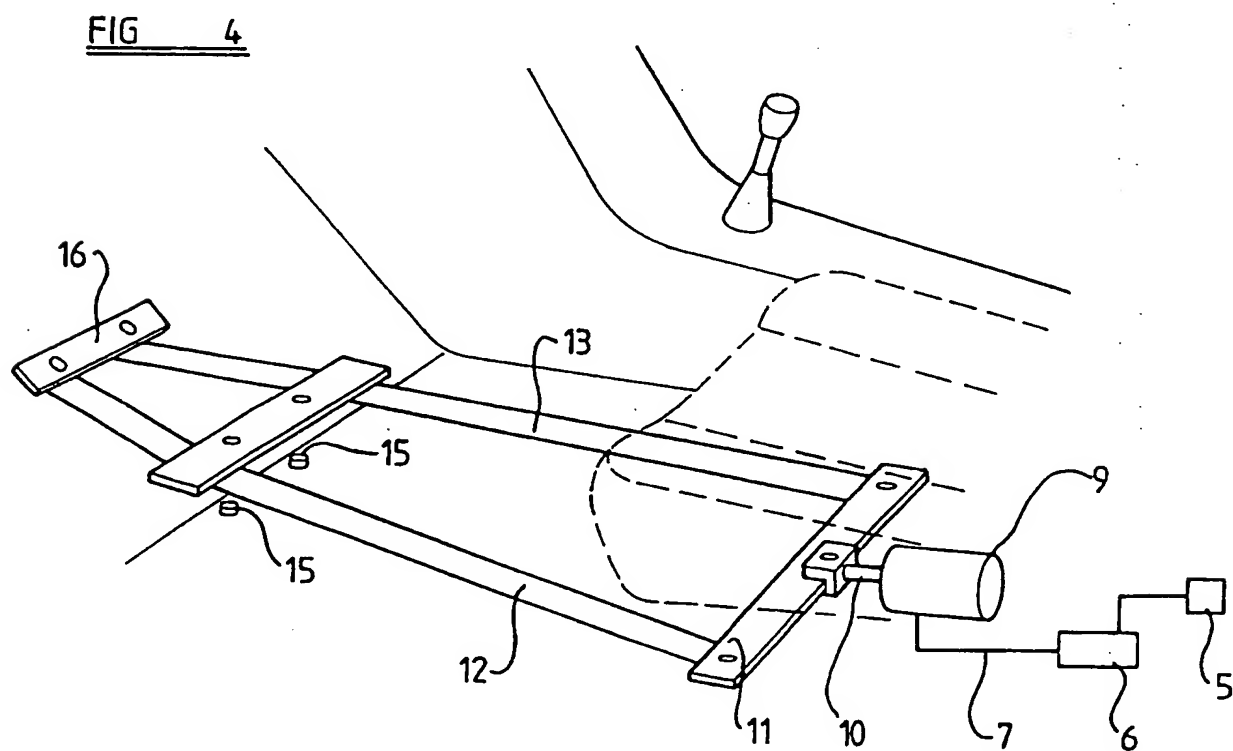
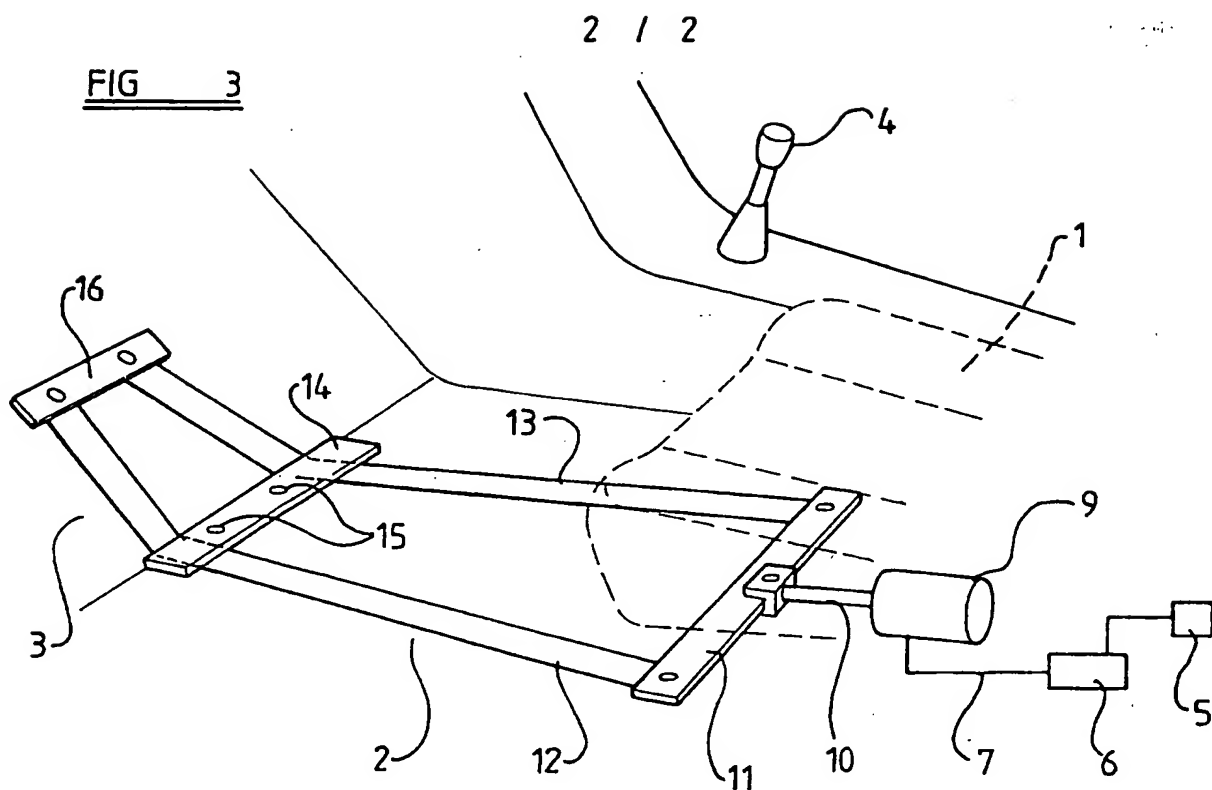
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5. An arrangement according to Claim 4 wherein the said at least one flexible element comprises two flexible straps.

6. An arrangement according to Claim 4 or 5 wherein the means adapted to apply tension to the or each flexible element comprise a piston-and-cylinder device, means to supply gas to the piston-and-cylinder device to move the piston and sensor means adapted to activate the means to supply gas in response to an accident being sensed.

7. An arrangement according to any one of Claims 4 to 6 wherein means are provided to retain part of the or each flexible element in a predetermined position adjacent a junction between two non-aligned portions of the floor of the vehicle.





INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/01317

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B60R 21/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B60R, B60N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 2333498 A1 (OTTO P. MOLT, MASCHINENFABRIK), 23 January 1975 (23.01.75), page 3, line 8 - line 22, figures 1,2	1
Y	--	2,3
Y	DE 3531805 A1 (DAIMLER-BENZ AG), 19 March 1987 (19.03.87), column 2, line 60 - column 3, line 11	2
Y	--	
Y	DE 4445487 C1 (AUDI AG), 2 May 1996 (02.05.96), column 2, line 8 - line 15	3
A	--	1,4-7

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of mailing of the international search report

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A

DE 4445485 C1 (AUDI AG), 2 May 1996 (02.05.96)

1,4-6

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/10/97

International application No.

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Patent document cited in search report			Publication date	Patent family member(s)	Publication date
DE	2333498	A1	23/01/75	NONE	
DE	3531805	A1	19/03/87	FR 2586979 A GB 2179898 A,B JP 1912571 C JP 6017097 B JP 62064642 A SE 462274 B,C SE 8603732 A US 4726438 A	13/03/87 18/03/87 09/03/95 09/03/94 23/03/87 28/05/90 07/03/87 23/02/88
DE	4445487	C1	02/05/96	NONE	
DE	4445485	C1	02/05/96	NONE	